General Training On Methodologies For Geological Disposal in North America

IAEA Network of Centers of Excellence

Institutional Arrangements for Managing Radioactive Waste:

Does It Matter? Should We Care?

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Disclaimer

The ideas presented here are solely my own. They do not represent the views of the Nuclear Waste Technical Review Board, an independent agency of the United States government charged with the responsibility for evaluating the technical validity of the Department of Energy's civilian radioactive waste management program.

Why Are We Here?

"Today the biggest challenges to waste disposition programs are societal in nature. Difficulties in achieving public support have been seriously underestimated in the past, and opportunities to increase public involvement and gain public trust have been missed."

U.S. National Academy of Sciences/National Research Council (2001)

Outline for the Presentation

- Explain what are “organizational, institutional, and social” considerations or issues
- Discuss why those issues have become increasingly important
- Consider the variety of approaches taken in Western democracies to address those issues
- Explore the special issue of public trust and confidence
- Ask where do we go from here

Conclusions

- Technological optimism has had serious negative consequences.
- Designing and implementing effective institutional arrangements can be as pivotal to the success of a repository program as designing and producing effective waste packages.
- There are many factors inherently associate with radioactive waste management that making designing and implementing those institutional arrangements very difficult.
- There are many paths that can be followed. Experiences in other countries can provide heuristic insights but not definitive prescriptions.
- Public trust and confidence may be key.

A Look Backward

“If the tanks we have turn out to have a life of 50 years, it will be very simple to be prepared at the right time with an alternative set of tanks and pump the liquids into the new tanks. We have extensively moved the liquid from one tank to another and are persuaded we can do this operation with perfect safety in perpetuity.”

Herbert Parker
Manager of the Hanford Reservation
Testimony before the JCAE in 1959

Technological Optimism

- An overwhelming faith in progress that admits of few limitations to the ability of scientific knowledge to solve problems
- A tendency to downplay substantially aspects of problem-solving that are not technical

➔ *Can lead to a poor understanding of a problem and the adoption of policies that prove to be inadequate*

Basic Point

- Technological optimism strongly influenced waste management problem solving and policy making early on.
- As a result, key decision-makers failed to appreciate
  - The level of technical uncertainty that had to be addressed
  - The need to obtain "consent" from broad segments of the public
  - The inescapable necessity to:
    - choose an overall strategy
    - develop legislation
    - select sites, whether for storage or disposal
    - create implementing organizations and strategies
    - establish a regulatory structure
- In short, they failed to appreciate the "social, organizational, and institutional" issues associated with radioactive waste management.

Experience Tells Us One Thing Very Clearly…

In Western, industrialized countries with strong democratic traditions, failure to address those institutional issues effectively and in a manner compatible with the national culture almost certainly will paralyze, if not significantly disrupt, disposal programs, regardless of the programs' technical merit.

The Perils

"We have concluded that, from a technical perspective, safety of the [disposal] concept has been, on balance, adequately demonstrated…But it does not have required level of acceptability to be adopted as Canada's approach for managing nuclear fuel wastes."

Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel (Seaborn Panel) (1998)

National programs in France, the United Kingdom, Germany, Belgium, and Switzerland have suffered the similar fates for similar reasons.

Institutional Issues Have Become More Visible

In a conscious effort to separate itself from the technological optimism that had existed, the very first publication of the U.S. Nuclear Regulatory Commission dealing with radioactive waste proposed the following goals and objectives (among others):

- The existence of scientific, technological, and organizational uncertainties in any waste management system shall be made explicit, along with the logic and procedures used to address them.
- Jurisdictions other than federal (i.e., state, local, and regional) shall be involved in the decision process from the inception of ideas to the implementation of the waste management system.
- Organizational and institutional components of the system shall be designed to ensure the detection and rectification of errors.
- Values not easily quantifiable shall be considered in the decision-making process.

NUREG-0300 (1978)

Overall Progress Has Been Fairly Slow

- Approaches that were adopted in the past tend not to be questioned until they collapse.
  - Organizational momentum is hard to overcome.
  - A sense of technological optimism persists in many quarters.
- The responsible authorities (implementers and regulators) tend to invest very little to design effective institutional arrangements.
  - Some countries, such as Sweden and Canada, have conducted systematic studies on how to implement effective arrangements.
  - The European Commission also is sponsoring work in this area.
  - But, as far as I know, neither the Department of Energy nor the Nuclear Regulatory Commission employs *and* utilizes the professional skills of individuals with advanced training and expertise in the social sciences.

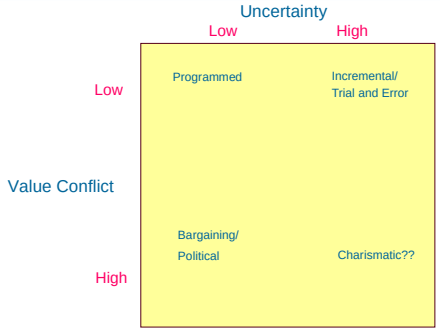
Why Is It Tough To Deal With Radioactive Waste?

- Strong public perceptions of risk
  - Dread
  - Involuntary
  - Invisible
  - Controllability
  - Severity of consequences
- Geographic equity
- Intra- and intergenerational equity
- Linked to a controversial energy production technology
- Long-term technical predictions
- Institutional stability and continuity

Radioactive Waste Management As An Extreme Case

- A large part of the reason why institutional issues have been so intractable is the peculiar properties of the radioactive waste disposal issue:
  - The magnitude of technical uncertainty is potentially very high.
  - Multiple, conflicting, intensely held values come into play.
- The combination of these two properties creates institutional design challenges that have few, if any, precedents.
  - Global climate change
  - Genetically modified organisms

Decision Strategies: Terra Incognita



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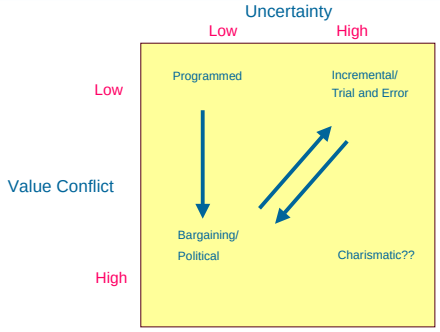

Managing Uncertainty: Transparency (I)

- The importance of being open and clear about the technical arguments that support waste disposal decisions has been emphasized by, among others, the OECD/NEA (1999) and the NAS/NRC (2001).
- Because the uncertainty associated with the technical arguments may ebb and flow as more is learned, transparency may increase and decrease in turn.
  - Safety case in Sweden
    - simple story: copper canisters in a compatible geological environment
    - more complex story: salinity; weld closure
  - Safety case for Yucca Mountain
    - simple story: low percolation means no waste transport
    - more complex story: high percolation; reliance on passivated metals

Managing Uncertainty: Transparency (II)

- The growing use of complicated performance assessments to support arguments about repository safety has posed a further challenge to transparency.
  - The process models employed are typically complex, and their abstraction may not be straight-forward.
  - The analysis requires numerous assumptions about parameters, distributions, and boundary conditions. These may be embedded so deeply as to be unfathomable.
- But performance assessments do present an opportunity to quantify uncertainty.
  - Such information could be quite useful for policy-makers.
  - Carrying out the necessary calculations may prove to be extremely difficult.

Managing Uncertainty: Transparency (III)

- A variety of institutional arrangements clearly have increased transparency.
  - Environmental impact assessments, such as used in Canada
  - "Stretching exercises," such as used in Sweden
  - Adjudicatory nuclear facility licensing proceedings, such as used in the United States.
- Simply adopting such arrangements does not guarantee that technical arguments are open and clear. Institutions may have to alter their cultures to encourage, rather than inhibit, personnel who advocate increased transparency.

Managing Uncertainty: Interpreting Science (I)

- When the science and engineering used to characterize a potential site or to evaluate the performance of a repository is at the cutting-edge, it expected that the interpretation of data and experiments can become contested.
- A Case in Point: The Presence of Bomb-Pulse ^{36}Cl at YM
  - Discovery of bomb-pulse ^{36}Cl first was reported in the mid-1990's.
  - Another national laboratory replicated the experiment several years later and was not able to find any bomb-pulse ^{36}Cl.
  - Additional experiments conducted by both laboratories using a common methodology and split samples did not resolve the disagreement.
  - The Nuclear Waste Technical Review Board concluded that the failure to resolve this disagreement strongly affected the Department of Energy's technical credibility.

Managing Uncertainty: Interpreting Science (II)

- In general, several institutional arrangements are available for evaluating empirical findings and resolving differences in interpretation.
  - External peer review
  - Further replication of critical experiments by independent investigators
- Employing these arrangements, however, could pose additional challenges to public confidence.
  - For example, the former approach was used after the discovery of bomb-pulse ^{36}Cl. It supported the initial experiments, but replication was undertaken nevertheless. It is unclear why.
  - The Department of Energy also has proposed using the latter approach to resolve divergent interpretations of bomb-pulse ^{36}Cl. This proposal could raise questions about "science by majority vote."

Resolving Value Conflict: Picking a Strategy

- Credible assessment of waste management options and technical approaches
  - United States: Generic Environment Impact Statement (1981)
  - Canada: Hare Report (1977); NWMO (2002)
  - Sweden: KBS-1 (1977); KBS-2 (1978); KBS-3 (1983)
- Political ratification of an option or approach
  - United States: Nuclear Waste Policy Act (1982); Amendments Act (1987)
  - Sweden: Stipulation Act (1977); Act on Nuclear Activities (1984)
  - Finland: Nuclear Energy Act (1987)
  - France: Nuclear Waste Act (1991)
  - Canada: Nuclear Waste Fuel Act (2002)
- Both appear to be necessary, but not sufficient, conditions for adopting and implementing a national strategy.

Resolving Value Conflict: Selecting a Site (I)

- Balancing local and national interests
  - Community referenda (Sweden)
  - Local veto with the possibility of a national override (but compare the U.S. and Sweden)
- Some site selection efforts have failed because institutional issues, including public involvement, were not adequately addressed by the responsible authorities.
  - Gorleben site in Germany
  - Sellafield site in the United Kingdom (URL)
  - Wellenberg site in Switzerland (L/ILW)

Resolving Value Conflict: Selecting a Site (II)

- Political processes either resolve value conflicts or certify their resolution.
  - United States: Congress approved the Yucca Mountain site.
  - Sweden: The Government approved two sites for intensive study.
  - Finland: Parliament passed the "decision-in-principle," which approved a site near the Olkiluoto nuclear power plant.
- The waste management implementer submits a license application to an independent regulator.
  - The U.S. Nuclear Regulatory Commission conducts an adjudicatory hearing on the license application. Its decision can be appealed to the courts.
  - In Sweden, SKI, and in Finland, STUK review the license application. Their decisions are final.

Resolving Value Conflicts: Involving the Public (I)

- Direct involvement
  - Local and national referenda (Sweden and Switzerland)
  - Community "stretching exercises" (Sweden---but compare Oskarshamn and Östhammer)
- Involvement by voting for a particular political party
  - From time to time, national parties include platform planks dealing with nuclear power in general or radioactive waste management in particular. (France, Germany, and Belgium)
  - Political parties may not always adhere to their platforms. (Sweden)

Resolving Value Conflicts: Involving the Public (II)

- Involvement in the pluralistic bargaining process that generally takes place among "elites"
  - This mechanism for involvement is the dominant one in the United States.
  - Implementers and regulators solicit public input on proposed policies or key documents such as environmental impact statements, technical analyses, and regulations.
  - Implementers and regulators typically have broad discretion to accept or reject inputs from the general public (as well organized interest groups).
    - Discretion can be limited by courts if the decisions are contrary to statute or unconstitutional.
    - Courts usually defer to an agency's interpretation of its mandate and to its technical judgments.
- Different mechanisms for involvement affect the power members of the public have in influencing policy.

Meriting Public Trust and Confidence (I)

- Why is public trust and confidence important?
  - On a pragmatic level, public trust and confidence is generally essential for institutions to carry out effectively missions assigned to them.
  - More fundamentally, however, trust and confidence makes a central contribution to sustaining the legitimacy of public organizations within a democratic system of governance.
- Research in the United States, which now has been replicated in the United Kingdom, suggests that trust in institutions dealing with radioactive waste is made up of two components.
  - Beliefs about the institution's technical competence
  - Affective beliefs about the institution's openness, reliability,credibility, and integrity.

Meriting Public Trust and Confidence (II)

"The greatest single obstacle that a successful waste management program must overcome is the severe erosion of public confidence in the federal government that past problems have created."

U.S. Office of Technology Assessment (1982)

"By any conceivable indicator, the Department of Energy arouses little trust and confidence from *any* sector of the public…That lack of trust and confidence is not an irrational reaction nor can it be discounted as simply a manifestation of the 'not-in-my-backyard' syndrome."

Secretary of Energy Advisory Board Task Force on Radioactive Waste Management (1993)

Meriting Public Trust and Confidence (III)

- Asymmetry Principle
  - Trust can be lost easily, but it takes sustained efforts over long periods of time to regain it.
- Constancy Principle
  - Most actions undertaken by institutions have consequences for public trust and confidence. They will be judged by how they trade-off trust for other valued considerations.

Where Do We Go From Here? (I)

- It is easier to say with confidence what should not be done than what should be done.
  - Being good technically is not enough. National programs for managing radioactive waste that fail to pay adequate attention to institutional issues do so at their risk.
  - There are many effective institutional arrangements. But the choice among them needs to be tailored to a nation's political and social culture.
  - How much is being invested to make and implement these choices in an informed manner?
- More research into what makes some arrangements effective and others not might be worth undertaking. But we know a fair amount. What is most often lacking is the will and commitment to apply what we know.

Where Do We Go From Here? (II)

- Public trust and confidence may be an important key
  - Institutions possessing it have "slack."
  - Institutions lacking it have large transaction costs and often face continuous opposition.
- The "background" level of public trust and confidence tends to vary from nation to nation.
  - In the United States, the level tends to be relatively low.
  - In Scandinavia, the level tends to be relatively high.
- Self-consciousness and sensitivity needed

Conclusions

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